Statement of Basis for Remedial Action
Rhodia's Charleston Plant, Charleston, South Carolina
May 2010

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1.0 Purpose of the Statement of Basis for Remedial Action

This Statement of Basis has been prepared to inform the public and provide an opportunity to comment on the proposed remedial action for impacted groundwater, soils, and sediments at Rhodia's Charleston Site. The site is located at 2151 King Street Extension, Charleston, South Carolina 29405, and has facility identification number SCD 003 358 389.

In the "Corrective Measures Study Report; GeoSciences, Inc., June 2009" Rhodia recommended final corrective measures to address impacted soils, groundwater, and sediments at its Charleston, South Carolina, facility.

The South Carolina Department of Health and Environmental Control (SCDHEC) has made a preliminary determination that the proposed remedial measures are appropriate, with conditions specified by the SCDHEC, because they are protective of human health and the environment. However, before the proposed remedial actions are approved as the final corrective action, the public is hereby provided an opportunity to comment on the proposed remedial action. At any time during the public comment period, the public may comment, as described in the "How Do You Participate" section. Upon closure of the public comment period, SCDHEC will evaluate all comments and questions with regards to modification of the proposed remedies.

This document describes the facility, provides an environmental history of the facility, defines the impacted media and the areas of concern, describes the remedies considered for addressing the areas and media of concern, identifies the proposed remedies, and explains the rationale for the selection of the preferred remedies.

2.0 Facility Description and History

The physical plant is located along the east bank of the Ashley River approximately 5 miles north of downtown Charleston, South Carolina (Figures 1 and 2). The site has been used for industrial activity since 1894. It was previously owned by the Virginia-Carolina Chemical Corporation (prior to 1963), Mobil Oil Corporation (1963 to 1985), and Albright & Wilson Americas (A&W - 1985 to 2000). Rhodia acquired A&W in 2000.

Historically, the plant mined phosphate rock from the Ashley River and converted it to superphosphate and phosphatic fertilizer at the site. Current productions include a spectrum of organic and inorganic phosphorus compounds.

3.0 Environmental History

On March 29, 1988, the previous owners of the site -- Albright & Wilson Americas, Inc. (A&W) -- submitted an application for an RCRA Part B permit renewal to the U.S. Environmental Protection Agency (EPA) Region IV for this facility. As a part of its approval of this permit, EPA conducted an RCRA Facility Assessment (RFA) at the Charleston plant. The findings of the RFA and subsequent communications between the EPA and the plant resulted in the identification of 36 solid waste management units (SWMUs), and four areas of concerns (AOCs A to D). Locations of the SWMUs and AOCs are identified in Figure 3. For 17 of the SWMUs and three AOCs, a determination was made that an RCRA Facility Investigation (RFI) was required. Rhodia with approval of SCDHEC, implemented a Corrective Measures at AOC D in 2007-2008; a report of "Final Corrective Action Implementation" was issued in April 2008.

Earlier voluntary environmental assessment activities at the site were initiated in 1981. In 1981, two environmental studies were performed by Mobil Research and Development Corporation (the site owners at the time). The 1981 environmental assessments included sampling of sediments from the Ashley River and the installation of monitor wells for groundwater assessment at the site.

Additional environmental assessments were performed from 1982 to 1990 to better characterize site hydrogeology, define soil and groundwater contamination, and determine potential environmental and health risks associated with such contamination. Since 1990, site assessment activities have been directed toward compliance with the RFI objectives.

Phase I RFI activities were completed in October 1994. An interim Phase I RFI report and a proposed Work Plan for Phase II RFI sampling were submitted to the South Carolina Department of Health and Environmental Control (SCDHEC) in February 1995; the Final Phase I RFI Report was submitted in April 1995. EPA and SCDHEC issued their comments on the Phase I RFI report in September 1996. These comments were addressed both in a meeting with SCDHEC and EPA in December 1996 and also in the memorandum of agreement and response to comments issued in July 1997.

To address a "wet weather springs" (i.e., surface discharge of groundwater during episodes of heavy rainfall), a groundwater-interception and recovery system was installed at the site around the General Products Units (GPU) in 1996. The system consists of three intersecting (U-shaped) groundwater-interceptor trenches and two groundwater-recovery wells. The location, layout, and cross sections of this trench are shown in Figure 4. This system was intermittently operated from its installation in 1996 to 1999; it was placed back in operation in 2003, as a part of the interim groundwater-remediation plan at the site.

SCDHEC issued its conditional approval of the Phase II RFI Work Plan in May 1998. Rhodia met with SCDHEC in July 1998 to address the provisions of the conditional approval and issued a memorandum of agreements (July 1998) to document the agreements reached in this meeting. Phase II RFI activities commenced in September 1998 and were completed in November 1998. A report of Phase II RFI activities and findings was submitted to SCDHEC in July 1999.

To address the presence of elemental phosphorous in the sediments of the Ashley River in an area around a former outfall, Rhodia, at the request of SCDHEC, implemented sediment stabilization measures in September 2000. These measures included the placement of a geotexile fabric and sand cap on the potentially impacted sediments in the Ashley River; a report of site activities was issued in October 2000. Rhodia collected additional sediment samples for elemental phosphorus analysis in July 2007, and based on the results of this analysis, extended the sediment cap in calendar year 2008 (Figure 5). This cap system was the final remedy for the impacted sediments of the Ashley River; the Statement of Basis for this remedy was posted for public comments in December 2007 and the final remedy was implemented in March through December 2008.

In correspondence dated December 9, 1999 (S. Sherrit to B. Tims), SCDHEC requested that A&W submit an interim-stabilization work plan to address the presence of arsenic in groundwater in the area adjacent to the Ashley River. A work plan for interim groundwater remediation was submitted to SCDHEC in July 2000; SCDHEC approved this plan in January 2001, and the plan was implemented in the period from August to December 2001. The interim groundwater-stabilization measures consist of a groundwater-interception trench and recovery wells and are referred to as the Groundwater Remediation System (GRS). The layout and cross sections for the GRS are included in Figures 6A and 6B. The GRS was started up in February 2002, and a report of field activities and groundwater sampling associated with the start-up of GRS was submitted to SCDHEC in July 2002.

Rhodia submitted a work plan for Phase III RFI assessments in June 2002; this plan was approved in January 2003. Phase III RFI activities were performed in February 2003; the findings of the Phase III RFI were reviewed with SCDHEC in April 2003, and a report of findings was submitted to SCDHEC in May 2003.

In a letter dated March 29, 2002 (D. Taylor to R. Quinn), SCDHEC requested that Rhodia conduct a Corrective Measures Study (CMS) at SWMUs #1, 2, 10, 12, 17, 21, 27, 30, and 35. Rhodia submitted a CMS report to SCDHEC in May 2003. SCDHEC issued its comments on the CMS report in June 2004. Rhodia issued its response to SCDHEC’s comments and a revised copy of the CMS report in January 2005. In September 2005, SCDHEC issued comments on the January 2005 submittal. Rhodia met with SCDHEC in December 2005 and it was agreed that additional site assessments (previously proposed by Rhodia) were required to complete the delineation of the extent of groundwater impact at the site prior to the submittal of a revised CMS. These assessments were implemented in a phased approach from early 2006 to mid 2007.

Rhodia responded to SCDHEC comments of September 2005 in January 2007, and SCDHEC issued additional comments on the CMS in July 2007. Rhodia met with SCDHEC at Rhodia’s facility in August 2007 to review these comments, discuss Rhodia’s preliminary responses to these comments, and conduct a site tour. In this meeting it was decided that Rhodia would submit a fast-tracked CMS report to address elemental phosphorus-impacted sediments of the Ashley River adjacent to the plant. The CMS for elemental phosphorus-impacted sediments was submitted to and approved by SCDHEC in December 2007. The remediation plan recommended in this CMS was implemented in calendar year 2008. Rhodia and SCDHEC met in May 2008 at the site to review project progress; SCDHEC and Rhodia communicated after this meeting, and a follow-up technical meeting was held in July 2008 to address any remaining technical issues prior to the submittal of the CMS report. Rhodia submitted a response-to-comments document in December 2008; SCDHEC issued comments on this submittal in May 2009. Rhodia replied to SCDHEC’s correspondence of May 2009 in June 2009. The June 2009 submittal included the final CMS report and Rhodia’s response to SCDHEC comments of May 2009. On September 30, 2009, SCDHEC issued a conditional approval of the CMS (Appendix A).

4.0 Nature and Extent of Contamination at the Site

Environmental site-assessment activities performed at the site indicate that the constituents detected most frequently and at higher concentrations include arsenic, EDC, and DCFT in groundwater; metals (primarily arsenic), DCFT, and elemental phosphorus in soils; and metals (primarily arsenic) in sediments. A summary of site-assessment activities and findings follows.

5.0 Arsenic in Groundwater

A total of 52 in-situ groundwater samples were collected and analyzed for total and dissolved arsenic during the Phase I and II RFI. Rhodia also collected 16 shallow in-situ groundwater samples from March to December 2006 and analyzed these samples for total arsenic.

Groundwater samples from site monitor wells were collected during the Phase I and II RFI and later were analyzed for arsenic and other parameters. Historical analytical test results for arsenic concentrations in shallow and deep monitor wells at the site are included in Figures 7A and 7B, and those for the most recent measurement event ("Semi-annual Groundwater Monitoring Report, GeoSciences, Inc, October 2009") are included in Figures 8A to 8D, respectively.

Using the regulatory limit for arsenic for the site (50 ug/l) as the delineation factor, the area of arsenic impact in shallow sands (Figure 8A) includes 3 isolated areas around monitor wells ARMW-9, ARMW-6 & MW-13, and EDCS-9 & ARMW-11; and a main area of impact in the west-central portion of the site extending from monitor wells ARMW-4 and EDCS-1 to the vicinity of the Ashley River.

Using an MCL of 10 ug/l for arsenic (as the delineation criterion), the area of arsenic impact (Figure 8B) includes the entire operations areas of the site, portions of the Bone Yard area (a vacant area previously used for unused equipment storage), and an area in the southeast corner of the site.

The area of arsenic impact in deep sands (Figures 8C and 8D) extends from just west of monitor well 35-MW-1 to the vicinity of the Ashley River. The depth of deep monitor wells ranged from 37 to 47 feet, below grade.

6.0 EDC in groundwater

A total of 60 in-situ groundwater samples were collected and analyzed for 1,2-dichloroethane (ethylene dichloride-EDC) during Phase I and II RFI activities. An additional six in-situ groundwater samples (i.e., 17-GW-1, 17-GW-2, 28-GW-1, 28-GW-2, EDCIGW-1, and EDCIGW-2) were collected in March and August 2006. Locations of these samples are identified in Figure 9.

In addition to the in-situ groundwater samples, groundwater samples from site monitor wells were also collected and analyzed for EDC during the Phase I and II RFI and later.

Maps of the most recent EDC concentrations in shallow and deep sands ("Semi-annual Groundwater Monitoring Report, GeoSciences, Inc., September 2009") are included in Figures 10A and 10B, respectively.

The most recent EDC distribution map for shallow and deep sands (Figures 10A and 10B) shows that the main area of EDC impact in shallow sands extends from SWMU #35 to the western boundary of the site. A second and apparently isolated area of EDC impact in shallow groundwater exists around monitor well EDCS-8 in the Drum Storage area. The area of impact in deep sands is smaller and the concentrations lower than those for shallow sands.

7.0 Dichlorofenthion (DCFT) in groundwater

Analytical testing of in-situ groundwater samples and samples from site monitor wells during the Phase I RFI (Figure 11) indicate that dichlorofenthion (DCFT) was detected in five shallow monitor wells and six in-situ groundwater samples associated with SWMUs #17, #30, and #35; DCFT was also detected in deep monitor wells EDCD-3 and 17-MW-1D.

DCFT distribution maps for the shallow and deep sands for the June 2009 sampling event are included in Figures 12A and 12B, respectively. These figures indicate that the presence of DCFT in groundwater is limited to a narrow strip of land immediately around the former Organic Waste Ditch (SWMU #17) and extending from SWMU #35 to the vicinity of the Ashley River. The area of DCFT impact in deep sands is believed to be that around monitor well 17-MW-1D.

8.0 Metals in soils and sediments

The soil-sampling program for metals included the collection of more than 180 soil samples from various depths and locations across the site; these samples were analyzed for metals and other parameters (Figure 13A). The metals detected most frequently and at higher concentrations include arsenic and, to a lesser extent, lead, antimony, cadmium, chromium, and selenium. Arsenic concentrations in soils are included in Figure 13B; a map of areas where arsenic concentrations exceeded background is included in Figure 13C.

Sediment samples were collected from the Northwest Drainage Ditch and the Tidal Backwater Area in the northwest corner of the site. Analytical test results for these sediment samples are included in Figure 14.

9.0 DCFT in soils

A total of 42 soil samples were collected and analyzed for DCFT during the RFI activities. DCFT was detected in 9 out of 42 soil samples and principally in soils around SWMUs #30 and #35 (Figure 15A). The area along the Old Organic Wastewater Ditch (SWMU #17) was defined in a 1983 study as an area of DCFT impact.

In August 2008, Rhodia collected six soil samples from three soil borings at SWMU#17 (Figure 15B); analytical test results (Figure 15B) indicated that DCFT concentrations in soils in this area ranged from 0.49 mg/kg to 2900 mg/kg.

10.0 Elemental phosphorus in soils and sediments

Elemental phosphorus was detected in 2 of the 5 former Old Phossy Water Settling Ponds comprising SWMU #21 (Figure 16). Elemental phosphorus was detected in 5 out of the 32 soil samples collected in this area and at depths ranging from 3 to 16 feet below grade. Exploratory excavations associated with the interim groundwater-remediation measures in 2001 encountered elemental phosphorus at depths of 2 to 8 feet in some areas of SWMU #21.

The sediments of the Northwest Drainage Ditch and sediments from the Tidal Backwater Area at the northwest corner of the site, which would have received surface runoff from SWMU #21, were free of elemental phosphorus.

In 1981, 1988, and 2007, sediment samples from the Ashley River were collected along a former outfall from the Phossy Water Ponds and analyzed for elemental phosphorus. Analytical test results (shown in Figure 17) indicate that elemental phosphorus had entered the sediments of the Ashley River through surface runoff during the operation of the ponds (1950 to 1970). A final remedy for the impacted sediments of the Ashley River was approved by SCDHEC and implemented in 2008.

11.0 Organic Chemicals in Soils

Soil samples collected during the RFI were analyzed for VOCs and SVOCs. As mentioned earlier, DCFT was detected at SWMUs #17, #30, and #35; EDC and a number of other VOCs and SVOCs were also detected in some soil samples at SWMU #35.

Polyaromatic hydrocarbons were detected at SWMU #27 and #30. Concentrations of VOCs and SVOCs for soil samples collected during Phase I and II RFI are included in Figures 18A and 18B.

12.0 Sources of Soil and Groundwater Contamination

The detection patterns indicate that the constituents present in groundwater, soils, and sediments at the site are likely the result of multiple sources which appear to have occurred early in the plant history. A summary of the findings of the RFI activities with respect to various possible sources of contaminants at the site follows.

13.0 Sources of Arsenic and Metals in Groundwater

Arsenic was present in a majority of the in-situ groundwater samples collected at the site. These included background (control) groundwater samples, as well as samples within the plant operations area, outside the plant operations area, and outside the physical boundaries of the plant. The presence of arsenic in the groundwater at the site is likely to be associated with the elevated concentrations of arsenic in the fill material used at the site early in site history, arsenic impurities in phosphate rock that was processed at the site many decades ago, arsenic in process byproducts such as slag which may have been left at the site, past plant operations, past waste-management practices, and incidental past releases.

In addition to arsenic, other metals, including antimony, chromium, lead, mercury, nickel, selenium, and thallium, were detected in at least one groundwater sample at the site. These metals are usually detected in tandem with arsenic, but at lower concentrations, and with much lower frequency than arsenic. The sources of impact for these metals are believed to be the same as those listed for arsenic.

14.0 Sources of EDC and other VOCs in Groundwater

EDC at the site has been detected in the groundwater in the vicinity of SWMUs #30, #35, and also in an isolated location in the Drum Storage area around monitor well EDCS-8. Past operations and waste-management practices at SWMUs #17, #30, and #35 are believed to be the source of the main area of EDC groundwater impact at the site; a source of EDC impact for the area in front of the Drum Storage Building has not been identified.

The former Special Products Unit (i.e., SWMU #35) is no longer in existence and does not constitute a potential future source of groundwater impact; the Old Organic Wastewater Ditch (SWMU #17) was backfilled in 1970; and the North Drainage Ditch (SWMU #30) has been cleaned and replaced with a concrete culvert system.

In addition to EDC, up to six other VOCs have been detected in the groundwater samples at the site in and around SWMU #35; these VOCs, however, are detected much less frequently, and at much lower concentrations, than EDC and are normally detected at locations where EDC concentrations in groundwater are present.

The source of VOCs detected in the groundwater at the site is believed to be past incidental releases at SWMU #35. By virtue of being a drainage ditch and a potential conduit of contaminant migration, SWMUs #17 and #30 may have also acted as secondary sources of impact for VOCs in groundwater at the site.

15.0 Sources of DCFT and other SVOCs in Soil and Groundwater

The likely source of DCFT in soils and groundwater at the site include SWMUs #17, 30, and 35. The source of DCFT at SWMU #35 is believed to be releases associated with past operations. The source of DCFT detected at SWMU #30 is believed to be the material within the former Old Organic Wastewater Ditch (SWMU #17) or the DCFT produced at SWMU #35. DCFT could have migrated from SWMU #35 to the local drainage features (SWMUs #17 and #30) through discharge of contaminated runoff. The sediments of the North Stormwater Drainage Ditch were removed in 1977 during an upgrade that included the installation of a concrete box and culvert drainage system in place of the old unlined North Stormwater Drainage Ditch (i.e., SWMU #30). Soils adjacent to the ditch reflect a DCFT impact.

In spite of the presence of relatively elevated concentrations of DCFT in soils at SWMUs #17, 30, and 35, groundwater at both of these SWMUs during the Phase I RFI and recent sampling was either free of DCFT or contained low-to-moderate concentrations of DCFT. Groundwater from monitor wells associated with SWMU #17 (i.e., 17-MW-1, 17-MW-2, and 17-MW-1D) contained concentrations of DCFT. The source of DCFT in groundwater at SWMU #17 is believed to be the DCFT present in soils at this SWMU.

In addition to DCFT, bis (2-ethlhexyl) phthalate (DEHP), 1,2-dichlorophenol, hexachlorobenzene, isophorone, and 2,4-dichlorophenol were the SVOCs detected in 1 to 3 (out of 62) soil samples analyzed for SVOCs at the site. These SVOCs were detected at the same locations as those where DCFT has been detected; the likely source of these SVOCs is believed to be past operations at SWMU#35.

16.0 Sources of Arsenic and other Metals in Soils and Sediments

The source of elevated concentrations of metals present in the soil in the northwest corner of the site, as well as other isolated areas, is believed to be naturally occurring concentrations of these metals in the fill material used at the site, impurities in the phosphate rock previously processed at the plant, or waste generated by the past operations or waste-management practices at the site. Fill placement (which took place in the early history of the plant) is expected to have been more prevalent in the lower-elevation areas adjacent to the river, and these are the areas where elevated arsenic concentrations in soils are normally encountered. The presence of fill material in portions of the northwest corner of the site was confirmed by the visible debris in surface soils, and also by the presence of construction and nonconstruction debris encountered in the vicinity of the Ashley River during the excavation of the groundwater interceptor trench in 2001. The construction debris encountered during the excavation of the this trench is from the demolition of site buildings which occurred many decades ago, but the source, extent, and placement history of the construction debris and also of the non-debris fill material cannot be identified with certainty. Metals in soils are detected around some SWMUs, as well as in non-SWMU-related areas.

Due to the lack of historical records and considering that phosphate rock was processed at the site in the past, it is likely that some of the arsenic and other metals present in soils have been generated as consequences of past site activities, including phosphate rock processing and related acid production.

17.0 Source of Elemental Phosphorus in Soils and Sediments

The sole source of elemental phosphorus in the sediments of the Ashley River was runoff from the former Phossy Water Ponds (SWMU #21) prior to 1970, and that for soils is the residual phosphorus that remained within the former ponds when they were closed in 1970.

18.0 Interim Groundwater Remediation

Interim groundwater remediation at the site included a groundwater-recovery system (GRS) installed in 2001 and an existing groundwater-recovery feature (the GPU system), which was incorporated into the interim groundwater-remediation plan in 2003. The GRS consists of a groundwater-interceptor trench approximately 900 feet long along the western boundary of the site, parallel to the Ashley River and hydraulically downgradient of all areas of impacted groundwater at the site. The trench is gravel filled; it is from 14 to 17 feet deep and 2 to 3 feet wide. Five groundwater-recovery wells, complete with pumps and controls for the extraction of groundwater from the recovery wells, plus six piezometers, were installed in the interceptor trench; five additional cleanout wells were also installed in the trench; the function of these latter wells was to allow desilting of the trench gravel gallery; these wells could also be converted to recovery wells if needed. A general layout of the GRS and a cross section of the trench are included in Figures 6A and 6B.

The GRS was installed in mid to late 2001; SCDHEC inspected the system in February 2002 and the system began operating in February 2002; and it has been operated without any prolonged interruptions since then. The recovery wells of the GRS are inspected weekly and maintained for optimal performance. The maintenance program includes desilting of the wells and the lines, and occasional replacement of the pumps. Groundwater recovery volumes are measured monthly, and groundwater samples for analytical testing are collected semiannually.

The most recent (June 2009) groundwater volumes from the recovery wells of the GRS at recovery wells RW-1 to RW-5 were 2,462,553; 2,561,454; 4,450,156; 3,833,746; and 787,079 gallons, respectively. The total groundwater volume recovered by the GRS since the start of the operation is 13,661,923 gallons.

The groundwater-interception system around the GPU was installed in mid-1996 and it was intended for controlling possible surface discharge of groundwater during periods of heavy rain (wet weather springs); it was incorporated into the interim groundwater remediation plan in 2003. This system consists of three intersecting (U-shaped) groundwater-interceptor trenches and two recovery wells. These trenches have a total length of 150 feet; they are from 6 to 8 feet deep, and from 2 to 3 feet wide. The layout and a typical cross section of this system are included in Figure 4.

The GPU groundwater-recovery system is downgradient and approximately 100 feet west of the former SPU area, which was the main source of EDC in the groundwater at the site. It should be noted that due to the shallow depth of the recovery wells and the interceptor trench, the potential yield at the GPU system is limited. From its installation in 1996 to its shutdown in 1999, the GPU system has recovered more than 700,000 gallons of groundwater. The GPU system has recovered more than 600,000 gallons of impacted groundwater from around the GPU since it resumed operation in 2003.

19.0 Corrective-action Objectives

Corrective action objectives were developed to abate, prevent, minimize, stabilize, and/or eliminate the release of site contamination; these objectives were used in developing and evaluating remedial alternatives at the site and were detailed in the approved CMS for the site (GeoSciences, Inc., June 2009); these objectives include the following:

1. Minimize the potential for human exposure to soils containing COCs at concentrations above USEPA Region 9 preliminary remediation goals (PRGs) for industrial soils. PRGs are risk based chemical concentration goals published by USEPA Region 9 for both industrial and residential soils. PRG concentrations for chemicals detected at the site were included in the approved CMS for the site.

2. Minimize adverse impact on the groundwater from surface and subsurface soils with chemical concentrations exceeding site-specific soil screening levels (SSLs) for protection of groundwater. SSLs for degradation/attenuation factors of 1 and 20 are included in USEPA Region 9 tables. Site specific SSLs were calculated in accordance with the EPA guidelines (detailed in the approved CMS report for the site) and are included in Table 1.

3. Minimize the potential for soils with COC concentrations higher than PRGs from being transported to surface water bodies (and eventually to the sediments in these waters).

4. Minimize the potential for off-site migration of and exposure to impacted groundwater.

5. Minimize the potential for exposure of ecological receptors to and migration of sediments with COC concentrations greater than PRGs for industrial soils.

20.0 Site Specific Action Levels

Site specific action levels determine which areas of the site should be evaluated for the implementation of remedial alternatives and the extent to which those areas should be remediated. Action levels for the site include the following:

Medium	Action Level
Soil	Industrial preliminary remediation goals (PRGs) for surface soils; calculated soil screening levels (SSLs) for surface and subsurface soils (Table 1). **Note 1:** when background concentrations are larger than PRGs or SSLs, use background concentrations as action level. **Note 2**: a concentration of 29 mg/kg (average background concentrations) is used for a PRG for arsenic.
Groundwater	26 ug/l for arsenic, MCLs for others **Note 1:** the 26 ug/l for arsenic was calculated based on the average arsenic concentrations in background monitor wells **Note 2**: the current regulatory limit (per facility RCRA permit) is 50 ug/l.
Sediments	Ecological risk based, as detailed in the approved Screening Level Ecological

	Risk Assessment Report (Appendix G of the approved CMS report for the site).

21.0 Proposed Remedy

In formatting a remedial response, Rhodia considered an array of remediation alternatives; these alternatives are summarized in this document; additional details of the proposed Corrective Measures and the basis for their selection are provided in the approved CMS report for the site (GeoSciences, Inc., June 2009). A summary follows:

22.0 Soils

Remediation alternatives considered for soils were:

1. No Action
2. Institutional Control: Institutional controls (ICs) will provide data on the nature of soil contamination and put in place measures for limiting intrusive activities and the potential for exposure in areas where metals, elemental phosphorus, DCFT, VOCs, or SVOCs have been detected in soils in excess of SSLs or in excess of PRGs for industrial soils. The ICs will also include a land use management plan in accordance with the facility RCRA permit. ICs and deed notice will be effective for the entire site and in compliance with facility RCRA permit.
3. Installation of an On-site Exposure Barrier Cap: The exposure barrier/leachate control cap would consist of an appropriate material that would be consistent with the current and future site usage; these materials include concrete; asphalt; synthetic liner and vegetation cover; and compacted-soil plus vegetation cover. Impacted areas currently beneath concrete or asphalt will be evaluated for the adequacy of the cap and if the current barrier can effectively control human exposure and leachate generation, then no additional cap will be placed in these areas.
4. Soil Vapor Extraction: This alternative includes the installation of soil vapor extraction (SVE) wells, a vacuum unit, and vapor treatment units at SWMU #35. The SVE would be intended to remove DCFT, EDC, and other organic chemicals from soils in this area.

5. Excavation and Off-site Disposal: This alternative includes excavation, transport, and off-site disposal of impacted-soils in a secure off-site landfill. Some pre-treatment may be necessary prior to disposal of impacted soils.

Soil Alternative 1 (No Action) is the least protective of human health and the environment; it provides no increased protection over the current conditions and would not be protective of human health or the environment.

Soil Alternative 2 (Institutional Controls - ICs) is protective of human health and the environment in regard to intrusive activities for impacted subsurface soils; land use control provisions of the ICs are also a requirement of the Facility RCRA Permit. Institutional controls do not provide protection of human health or the environment for impacted surface soils, as impacted surface soils under institutional controls could be subject to off-site migration through surface erosion and transport. This alternative does not reduce the potential for leachate generation for the impacted soils. ICs could act in tandem with other alternatives to make them more effective. This alternative is readily implementable and with proper record keeping, inspections, and reporting provisions would remain effective.

Soil Alternative 3 (Installation of an exposure barrier cap on COC-impacted soils) would be protective of human health and the environment by minimizing the potential for human exposure to surface soils and uncontrolled off-site migration through surface erosion and transport. The barrier cap will minimize leaching of COCs from soils to groundwater. This alternative is technically feasible, as the material and expertise for its implementation are locally available; with proper maintenance, inspections, and reporting this alternative would be effective over the long term.

Soil Alternative 4 (SVE) would be protective of human health and the environment by removing contaminants from impacted soils and treating these contaminants in a carbon-adsorption system. SVE technology is routine and has been successfully tested at this facility in the past. To remain effective, this alternative will require maintenance and testing over its operational life.

Soil Alternative 5 (excavation of impacted soils with off-site disposal) would be protective of human health and the environment by removal and disposal of impacted soils. Excavation of elemental phosphorus-impacted soils would create the likelihood of human exposure during excavation, handling, and disposal of such soils.

Soil Alternative 5 would be the least effective in the short term as it would require handling significant amounts of impacted soils, handling elemental phosphorus-impacted soils with a potential for generating fires or smoke-clouds, and transporting numerous truckloads of hazardous or solid waste over public roads. This would greatly increase the potential of exposure of the general public. Excavations of impacted soils in the operation areas of the site could cause structural foundation failure in the adjacent operating units with potentially catastrophic results. The engineering and administrative requirements are higher with Soil Alternative 5 than those with the other alternatives.

The applicable remedial action objective for soils includes minimizing:

1. The potential for human exposure to soils with COC concentrations exceeding PRGs for industrial soils.

2. The potential for COC-impacted soil from being transposed to surface-water bodies.

3. The potential for leachate generation and transport to groundwater.

Soil Alternative 1 would not achieve any of these objectives; Soil Alternative 2 partially achieves the first objective, but not the second and third ones; Soil Alternatives 3, 4, and 5 would meet all three objectives.

23.0 Recommended Corrective Measures for soils

Recommended corrective measures for site soils are complementary and non-competing; they include the following:

1. Institutional controls (ICs) including deed notices, land-use management controls, and physical controls. The ICs will be effective for specific areas of surface and subsurface soil impact, including the area of elemental phosphorus impact at SWMU #21; the area of metals impact in the northwest corner of the site (expanded SWMU #32), SWMUs #1, #2, #10, and #36; and the area of DCFT impact at SWMUs #17, #30, and #35 (Figure 19).

2. Placement of an exposure barrier cap in areas of impacted soils with COC concentrations exceeding SSLs for the protection of groundwater or PRGs for industrial soils (background for arsenic) at portions of SWMUs #10, #17, #21, #32, #35, and #36 to limit exposure to impacted surface soils and also to minimize potential leachate generation (Figures 20A to 20C). The exposure barrier cap will be maintained regularly and inspected semiannually; necessary repairs will be performed to maintain the integrity of the cap and to assure that it serves its design purpose.

3. Implementation of a pilot-scale soil-vapor-extraction system to evaluate the efficiency of such a system for the removal of DCFT and VOCs from shallow soils at SWMU #35 (Figures 21A and 21B). Initially a pilot-scale SVE will be implemented; the effectiveness of the SVE will be evaluated and pending the success of the pilot study, the SVE would be expanded to a full-scale system for SWMUs #35 and #17.

24.0 Groundwater

Remediation measures for groundwater at the site included the following:

1. No Action
2. Institutional Control: The ICs are similar to those described for soils and are intended to prohibit access and use of groundwater at the site except for environmental sampling purposes.
3. Permeable Reactive Barrier (PRB): A PRB involves the construction of an underground treatment zone perpendicular to the flow path of impacted groundwater. The target COCs are removed or altered by physical, chemical, and/or biological means that take place inside the PRB. The barrier would be installed downgradient of the impacted groundwater such that the target contaminant plume will enter the PRB under a natural hydraulic gradient; the plume will be interrupted and treated. Barrier walls are best suited for remote areas of arsenic impact in shallow sands at the northwest and southeast corners of the site where the impacted areas of groundwater are small and far away from the plant’s wastewater treatment unit. The reactive material inside the PRB would consist of approximately 30% zero valent iron, 45% gravel, 20% compost, and 5% limestone, lime, or other suitable material.
4. Groundwater collection and treatment: the groundwater collection system will consist of interception trenches and individual recovery wells followed by required treatment and disposal of recovered groundwater.

Groundwater Alternative 1 is the least protective of human health and the environment; it provides no increased protection over the current conditions and would not offer any protection over the long term; and it does not control off-site migration of impacted groundwater.

Alternative 2 (Institutional Controls) protects human health by restricting access and exposure to impacted groundwater, but it will not be protective of the environment, as it would not actively prevent potential off-site migration of COC-impacted groundwater.

Groundwater Alternatives 3 and 4 would be protective of human health and the environment, as they involve active recovery and treatment of impacted groundwater and hydraulic control measures to minimize potential off site migration of impacted groundwater. Groundwater alternative 4 is an extension of the existing interim groundwater remediation measure and groundwater alternative 3 is similar in its functions to alternative 4. Groundwater Alternative 3 is an appropriate remedial response for isolated and remote areas of groundwater impact at the site, as it does not require transferring of impacted groundwater to a treatment unit and the disposal of treated groundwater. The technology for implementation of Groundwater Alternatives 2, 3, and 4 is locally available and with proper maintenance, testing, and reporting, these alternatives can be effective long-term at the site.

Alternative 2 would help minimize the potential human exposure to impacted groundwater.

Alternative 3 meets the groundwater action objectives for the site by minimizing potential off site migration of impacted groundwater along the southern boundary of the site, minimizing potential human exposure to impacted groundwater, and the in-situ treatment of groundwater.

Alternatives 4 meets the remedial action objectives for the site by minimizing potential off site migration of groundwater along the western boundary of the site (along the Ashley River), minimizing potential human exposure to impacted groundwater, and the interception and treatment of impacted groundwater.

A capture zone analysis of the existing GRS indicates that:

- The current GRS trench is effective in capturing flow lines and preventing contaminant particles from moving across the trench into the Ashley River. In the southern part of the trench, there is the potential for particles to escape between the existing recovery wells, RW-1 and RW-2. There is also the potential for particles to cross the southern tip of the trench into the river. By extending the trench south by 120 feet and installing three additional recovery wells, all groundwater flow lines from the impacted areas can be captured along the entire western boundary of the site.

- In isolated areas of arsenic impact around monitor well ARMW-10 and ARMW-11, permeable reactive barriers are recommended for the treatment of impacted groundwater and prevention of potential off-site migration.

- To expedite the groundwater remediation, additional remedial measures in the form of four individual recovery wells are recommended for the area around ARMW-4; an additional recovery well is also recommended for the area around EDCS-1.

- Hydraulic capture of the impacted groundwater in the deep sands can be achieved by the installation of 10 recommended groundwater recovery wells.

- The effectiveness of the EDC and DCFT removal can be improved by installing a recovery well in the proximity of monitor well EDCS-1; this recovery well will effectively target the area of highest EDC concentrations at the site (around monitor well EDCS-1).

25.0 Recommended Corrective Measures for Groundwater

Recommended complementary and non-competing corrective measures for site groundwater include the following:

1. Institutional control to limit access to the groundwater in impacted areas.

2. Installation of two Permeable Reactive Barriers (PRB trenches) for in-situ treatment of arsenic-impacted groundwater at the remote locations around monitor wells ARMW-9 and ARMW-11 (Figure 22A), and the installation of a monitoring well west of the PRB assessment monitor well EDCS-9 And ARMW-11 to monitor arsenic concentrations; this PRB will be extended further if

indicated by analytical test results. It is recommended that a bench-scale treatability study with site groundwater be performed to select the most efficient reactive material for the PRB.

3. Extension of the existing groundwater-interceptor trench and recovery well systems south along the Ashley River by 120 feet and the installation of three additional recovery wells to control potential off-site migration of impacted groundwater and also to recover the intercepted groundwater for ex-situ treatment and disposal (Figures 22B and 22C) along the western site boundary.

4. Installation of four shallow groundwater recovery wells around monitor well ARMW-4 and one shallow recovery well around EDCS-1 to recover and treat impacted groundwater from these areas (Figures 22B and 22C).

5. Installation of ten deep individual groundwater-recovery wells in areas of groundwater impact in deep sands for hydraulic containment and recovery of impacted groundwater (Figure 23).

6. Corrective Measures for impacted groundwater will be incorporated into the facility RCRA permit; groundwater remediation systems will be operated and maintained until the remedial goals for groundwater at the site are met.

26.0 Sediments

The three alternatives considered for addressing impacted sediments are:

1. No Action
2. Removal and Off-site Disposal
3. In-place Stabilization

Sediment Alternative 1 is the least protective of human health and the environment of the three alternatives; this alternative provides no increased protection over the current conditions and would not control potential off-site migration of impacted sediments.

Removal and off-site disposal (Sediment Alternative 2) would be protective of human health and the environment by minimizing the potential for ecological exposure to and off-site migration of sediments. This alternative in the long term would be protective of human health and the environment; it has the short-term risks associated with the excavation, dewatering, and transport of impacted sediments.

Sediment Alternative 3 would be protective of human health and the environment by stabilizing the sediments and minimizing the potential for off-site migration of these sediments; this alternative involves short-term risks associated with sediment mixing; the long-term effectiveness of this alternative requires a bench-scale study to formulate the appropriate additive mix, which will maintain its stabilization and structural integrity over time.

The applicable remedial action objectives for sediments are to minimize the potential for ecological receptor exposure to and migration of COC-impacted sediments. Sediment Alternative 1 would not meet these objectives, whereas sediments alternatives 2 and 3 would meet these objectives.

Sediment Alternative 1 would not reduce COC mobility, toxicity, or volume; Sediment Alternative 2 would reduce the volume of the impacted sediments; and Sediment Alternative 3 would reduce mobility and toxicity of the COC-impacted sediments.

27.0 Recommended Corrective Measures for Sediments

In-place stabilization of sediments in a portion of the Northwest Drainage Ditch (SWMU # 32) to minimize the potential migration of these sediments to the adjacent Tidal Backwater Area (Figure 24).

28.0 Public Participation

To facilitate public participation in the corrective action process at the site, the following actions have been taken:

- A local information Repository has been established;
- Statement of Basis has been developed; and
- A mailing list has been prepared, and this Statement of Basis and the Public Notice have been mailed to the facility mailing list.

29.0 How Do You Participate

SCDHEC invites public review and comments prior to implementation of the proposed remedial action at Rhodia's Charleston plant. The public comment period for the proposed remedial actions will begin May 9, 2011, and end 45 days thereafter.

The Statement of Basis and the documents associated with the investigation and remedial actions proposed for the Corrective Measures Study – Rhodia's Charleston Site will be available for public review at:

South Carolina Department of Health and Environmental Control

Bureau of Land and Waste Management/ Stern Business Building

8911 Farrow Road; Columbia, South Carolina 29203; Phone: (803) 896-4000

Charleston County Library

68 Calhoun Street

Charleston, SC 29401

South Carolina Department of Health and Environmental Control

Region 7 Environmental Quality Control Office

1362 McMillan Avenue, Suite 300

Charleston, SC 29405

Any comments on the proposed remedial actions and/or requests for a public hearing should be sent to:

Stephen Crowell, PE, Environmental Engineer

Division of Waste Management / Bureau of Land and Waste Management

SCDHEC

2600 Bull Street

Columbia, SC 29201

The documents associated with the site-investigation and remedial-action activities related to the entire site are stored in an information repository that is maintained at the Charleston County Library and are available for review by the public.